Head Capsule Widths of the Walnut Caterpillar[1]

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Abstract: Head capsule widths on intact walnut caterpillar larvae were relatively uniform within an instar. Those from intact larvae compared favorably with widths of head capsules shed during molting for the same instar, for the 1st four instars. Head capsule widths differed from 1 instar to another and indicated that 5 instars constituted the larval stage. Finally, head capsule width can apparently be safely used to identify the instar of field collected walnut caterpillar feeding on pecan foliage in Texas.

The walnut caterpillar, *Datana integerrima* Grote and Robinson, is indigenous to the U.S.A. east of the Rocky Mountains (Haseman 1940) and during epidemic years defoliates trees in the family Juglandaceae over large areas. For the last three years (1973–1975), the walnut caterpillar was epidemic in parts of southcentral and southeast Texas (Harris and Van Cleave 1974). Unprotected pecan trees in these areas of the state were partially to totally defoliated.

The life history of the walnut caterpillar observed during this period generally agrees with that reported by Baerg (1928), Haseman (1940), and Hixson (1941). Diapause is facultative, with 2–3 generations occurring in Texas depending on latitude.

To facilitate field studies of walnut caterpillar biology, including predation, parasitism, feeding, colony mortality etc., a method for field identification of larval instars is needed. Although Dyar (1890) reported that head capsule widths of lepidopterous larvae proceed in a geometric progression as the larvae advance in instar and that head capsule width does not change during a stadium, Gaines and Campbell (1935) noted that the number of instars of *Heliothis zea* Boddie is influenced by its food plant and Peterson and Haessler (1928) observed that the number of instars of *Grapholitha molesta* (Busck) is influenced by food and temperature. Earlier investigators of the walnut caterpillar each reported different larval head capsule width measurements

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(Dyar 1890, Baerg 1928, Haseman 1940, Hixson 1941) and did not include measurement ranges. Baerg (1928) reported measurements for 6 instars from insectary-reared larvae. Preliminary investigations in our own laboratory yielded yet another set of measurements that could not be reconciled completely with those of any previous report. In light of the above, this study was conducted to evaluate the usefulness of head capsule widths in determining the various instars of field collected walnut caterpillar.

MATERIALS AND METHODS

Walnut caterpillar egg masses were collected at various locations and larvae reared in the field on pecan trees at College Station, Brazos County, Texas during the summer months of 1974 and 1975. Completely sclerotized head capsules of all larval instars were severed from the body, or collected from exuvia for measurement. Head capsules from 4th instar exuvia were collected at various times from numerous locations containing endemic and epidemic populations of walnut caterpillar.

The greatest width across each head capsule was measured with an ocular micrometer in a dissecting stereo microscope.

Attempts to rear field-collected colonies in the laboratory were abandoned when it was found that an occasional colony went through 6 instars and that head capsule widths were somewhat variable within and between instars. (This may account for some of the discrepancies noted earlier as Hixson (1941) suggested.) Consequently, all investigations were made on natural or established field colonies.

Larvae, or head capsule exuvia were collected daily from closely observed and marked field colonies from each of 3 generations during the 2 year period of the investigation. Duncan's multiple range test (.05 level) was the statistic used to assess head capsule width differences, 1) within an instar among locations and generations 2) among instars among locations and generations and 3) within an instar between head capsules and head capsule exuvia.

Voucher specimens of head capsules and adult walnut caterpillar have been deposited in the collection of the Entomology Department, Texas A&M University, College Station.

RESULTS AND DISCUSSION

Head capsule widths of the walnut caterpillar, indicated that this species has 5 instars (Table 1). Typical means and standard deviations calculated for 20 walnut caterpillar head capsules for each instar reared at College Station are 0.443 ± .017, 0.836 ± .023, 1.413 ± .064, 2.638 ± .15 and 4.349 ± 183 mm for 1st–5th instars, respectively (1st summer generation, 1974). Comparing these measurements to those of succeeding generations indicated there was no

TABLE 1. Head capsule width measurements of walnut caterpillar that have been pooled form all locations and generations in Texas.

Instar	Range (mm)	Mean (mm)
1	.391– .495	.445
2	.716–1.000	.839
3	1.061–1.650	1.400
4	1.929–3.190	2.620
5	3.748–5.000	4.365

overlap in head capsule width from one instar to another regardless of generation. Daily measurements of 10 head capsules per instar indicated no differences in width during an instar.

Head capsules exuvia of the first 4 instars remain whole, whereas those of the 5th instar are usually split. A camparison of head capsule width to the head capsule exuvium of the same instar indicated no differences in size for the first 4 instars.

Head capsules collected from 4th instar exuvia at different locations, some containing endemic and some epidemic populations of walnut caterpillar, were relatively distinct from those of the other 4 instars in width. Head capsule widths from 4th instar larvae in endemic populations were also indistinguishable from those in epidemic populations.

The data indicate that the walnut caterpillar has 5 distinct instars on pecan in all 3 field generations in Texas and that the relative uniformity of head capsule widths within an instar, among colonies, generations, and years and within the 4th instar among locations and endemic and epidemic populations, makes head capsule width useful in identifying the instar of field-collected walnut caterpillar in Texas.

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